ATTORNEY DOCKET NO. HAR66 816 CONT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of McCandless, et al.

Serial No.: Unassigned | Art Unit: 2821

Filed: Herewith | Examiner: M. Wimer

Title: POLARIZATION PLATE

PRELIMINARY AMENDMENT

The Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Sir:

Preliminary to examination of the subject application, Applicant amends the application as follows:

In the Specification:

Page 2, please insert the following paragraph immediately following "RELATED APPLICATIONS";

--This application is a continuation of Application Serial No. 09/267,251 filed March 12, 1999 for "Polarization Plate".--

Please add the following paragraph after the last paragraph on page 6:

--FIGURE 9 depicts a three dimensional view of a simplified version, for clarity, of the alternative embodiment of the polarization plate illustrated in FIGURE 8.--

Please add the following paragraph after the paragraph ending on page 14 line 21:

--For example, Figure 9 is a three-dimensional view of a simplified version of the polarization plate shown in Figure 8. For clarity, only one set of tapered areas leading to the slit shown in Figure 8 is depicted. It is to be understood that two sets of tapered areas may be provided on each side of the polarization plate. The polarization plate 910 is shown with one waveguide section 931 on one side of the polarization plate and another waveguide section 941 shown on the opposite side of the polarization plate. Typically, the waveguides 931 and 941 are either cross-polarized or co-polarized with respect to each other. It is to be understood that in operation, the waveguide sections would be joined with the polarization plate as discussed elsewhere in the application. The slit 901 through the polarization plate is shown with the tapered areas 920 and 921, which correspond to the tapered areas 820 and 821 depicted in Figure 8. As previously discussed, the tapered areas 920 and 921 may provide a more subtle transition in polarization between the waveguide 931 and the slit 901--

Please replace the paragraph which bridges pages 10 and 11 with the following paragraph:

--However, it should be appreciated that due to the characteristics of horn antenna 520 being asymmetric with respect to the axes of Arrow A and Arrow B, rotation of the antenna to provide orthogonal polarization may provide undesired results, such as unacceptable side lobes in one orientation or undesired beam width or height in one of the

other orientations. Accordingly, a preferred embodiment of the present invention utilizes an orthogonally polarized antenna such as shown in FIGURE 5B in order to provide dual polarization wherein the antenna beams for each such polarization are substantially similar. Accordingly, wave guide portion 511 consistent with the polarization of antenna 521 is disposed in mounting plate 510 in an orientation orthogonal to that of wave guide portion 501 of FIGURE 5A. Therefore, by placing face 512 of mounting plate 500 in juxtaposition with face 402 of polarization plate 400 such that arrow A is in the vertical orientation horizontal polarization may be realized.--

In the Drawings:

Please add FIGURE 9 to the application.

In the Claims:

Please cancel Claims 1-39 without prejudice.

Please add the following new Claims:

-- 40. (New) A system for coupling a first signal path to a second signal path so as to allow a signal propagating in said first path with a first polarization to propagate in said second path with a second polarization, comprising:

means for coupling said first and second paths including means for rotating the polarization of the signal in a plurality of increments from said first polarization to said second polarization.

41. (New) The system of Claim 40 wherein said plurality of increments is two.

42. (New) The system of Claim 40 wherein each of said plurality of increments rotates the polarization of the signal by a substantially equal amount.

43. (New) The system of Claim 40 wherein said first polarization is substantially identical to said second polarization.

44. (New) The system of Claim 43 wherein said plurality of increments is two and wherein the rotation of the polarization of the signal for each of said two increments is substantially equal in magnitude and opposite in rotational direction.

45. (New) The system of Claim 40 wherein said first polarization is substantially orthogonal to said second polarization.

46. (New) The system of Claim 45 wherein said plurality of increments is two and wherein the rotation of the polarization of the signal for each of said two increments is substantially 45°.

47. (New) The system of Claim 40 wherein the distance between rotations along the path of propagation is approximately one quarter of the wavelength of said signal

48. (New) The system of Claim 40 wherein said signal is a radio frequency signal in the range of 2 to 110 GHz.

49. (New) The system of Claim 40 wherein said signal is a radio frequency signal is in the microwave frequency range.

50. (New) The system of Claim 40 wherein said first path is associated with a radio communication apparatus and said second path is associated with an antenna.

51. (New) The system of Claim 50 wherein said antenna is a polarized antenna and the polarization of said polarized antenna matches the polarization of the second path.

52. (New) The system of Claim 40 wherein said first path is associated with an antenna and said second path is associated with a radio communication apparatus.

53. (New) The system of Claim 52 wherein said antenna is a polarized antenna and the polarization of said polarized antenna is the same as the polarization of the first path.

54. (New) In a system for coupling a first signal path to a second signal path wherein a signal propagating has a first polarization in said first path and a second polarization in said second path, the improvement wherein the polarization of the signal is rotated in a plurality of increments.

55. (New) The system of Claim 54 wherein said plurality of increments is two.

56. (New) The system of Claim 54 wherein each of said plurality of increments rotates the polarization of the signal by a substantially equal amount.

57. (New) In a system having a first wave guide configured for a first polarization, a second wave guide configured for a second polarization, and a coupler configured for a third polarization, the improvement wherein said coupler is configured to effect substantially equal changes in the polarization of a signal propagating through said

system at the junction of said first wave guide and said coupler and at the junction of said coupler and said second wave guide.

58. (New) The system of Claim 57 wherein said first polarization is different from said second polarization; and

wherein said changes are additive.

59. (New) The system of Claim 57 wherein said first polarization is the same as said second polarization; and

wherein said changes oppose each other.

60. (New) A universal coupler for coupling a signal through a first wave guide configured for a first polarization and a second wave guide configured for a second polarization comprising a plate having a thickness along the wave guide substantially equal to one quarter wavelength of the signal and an aperture configured for a polarization different from both said first and second polarizations.

61. (New) The coupler of Claim 60 wherein said first and second polarizations are the same.

62. (New) The coupler of Claim 60 wherein said first and second polarizations are different; and

wherein the polarization of said coupler is substantially at the midpoint of said difference in polarization.

63. (New) A method of coupling a signal propagating from a first wave guide configured for a first polarization to a second wave guide configured for a second polarization through a coupler configured for a third polarization comprising the steps of:

(a) rotating the polarization of the signal at the end of the first wave guide in a direction determined by the relative polarization of the first wave guide and the coupler; and

(b) rotating the polarization of the signal at the beginning of the first wave guide in a direction determined by the relative polarization of the coupler and the first wave guide.

64. (New) A method of coupling a signal propagating from a first wave guide configured for a first polarization to a second wave guide configured for a second polarization through a coupler configured for a third polarization comprising the steps of:

(a) rotating the polarization of the signal at the end of the first wave guide in a first direction; and

(b) rotating the polarization of the signal at the beginning of the first wave guide the same amount and in the same direction..

65. (New) A method of coupling a signal propagating from a first wave guide configured for a first polarization to a second wave guide configured for a second polarization through a coupler configured for a third polarization comprising the steps of:

(a) rotating the polarization of the signal at junction of the first wave guide and the coupler in a first direction; and

(b) rotating the polarization of the signal at the junction of the coupler and the second wave guide the same amount and in the opposite direction.

66. (New) A method of operably coupling an antenna configured for either of two polarizations to a wave guide configured for either of the same two polarizations comprising the step of coupling the antenna to the wave guide through a coupler configured for a single polarization differing from both of the two polarizations.

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67. (New) The coupler of Claim 66 wherein the difference between the polarization of the wave guide and the coupler is substantially the same as the difference between the polarization of the coupler and the antenna.

68. (New) A waveguide system for propagating a signal wherein said signal enters said waveguide system oriented with a first polarization and exits said waveguide system oriented with a second polarization, said waveguide system comprising:

a first waveguide adapted to be operatively connected to a polarization plate, said first waveguide comprising a first passage for propagating said signal through the first waveguide wherein said first passage is oriented substantially similar to the orientation of the signal when the signal is oriented with said first polarization;

a second waveguide adapted to be operatively connected to the polarization plate, said second waveguide comprising a second passage for propagating said signal through the second waveguide wherein said second passage is oriented substantially similar to the orientation of the signal when the signal is oriented with said second polarization; and

a polarization plate adapted to be operatively connected to said first and second waveguides so as to allow for the propagation of the signal from the first waveguide where the signal is oriented with the first polarization, through said polarization plate, to the second waveguide where the signal is oriented with the second polarization, said polarization plate comprising:

a slot for propagating said signal wherein said slot is substantially similar in shape to said first passage and said second passage and wherein said slot is oriented so as to be rotationally offset, about an axis running longitudinally through the first and second passages and through said slot, from the orientation of the first passage and the orientation of the second passage,

so that said signal enters the waveguide system oriented with said first polarization and exits said waveguide system with said second polarization.

69. (New) The waveguide system of Claim 68 wherein said first polarization is substantially identical to said second polarization.

70. (New) The waveguide system of Claim 68 wherein said first polarization is substantially orthogonal to said second polarization.

71. (New) The waveguide system of Claim 68 wherein the amount of rotational offset of the slot in the polarization plate from the orientation of the first passage is substantially 45°.

72. (New) The waveguide system of Claim 68 wherein the rotational offset between said first path and said slot is the same as the rotational offset between said slot and said second path.

73. (New) The waveguide system of Claim 68 wherein said signal is a radio frequency signal in the range of 2 to 110 GHz.

74. (New) The waveguide system of Claim 68 wherein said signal is a radio frequency signal is in the microwave frequency range.

75. (New) The waveguide system of Claim 68 wherein said first path is associated with a radio communication apparatus and said second path is associated with an antenna.

76. (New) The waveguide system of Claim 75 wherein said antenna is a polarized antenna and the polarization of said polarized antenna is the same as the polarization of said second path.

77. (New) The waveguide system of Claim 68 wherein said first path is associated with an antenna and said second path is associated with a radio communication apparatus.

78. (New) The waveguide system of Claim 77 wherein said antenna is a polarized antenna and the polarization of said polarized antenna matches the polarization of the first path.

79. (New) The waveguide system of Claim 68 wherein said polarization plate includes a first tapered portion to thereby create a first transition region between said first passage and said slot.

80. (New) The waveguide system of Claim 79 wherein said polarization plate further includes a second tapered portion to thereby create a second transition region between said slot and said second passage.

81. (New) The waveguide system of Claim 68 wherein the length of said slot along said longitudinal axis is selected so as to provide in a predetermined manner a desired signal path attribute.

82. (New) The waveguide system of Claim 81 wherein said signal path attribute includes a desired impedance.

83(New). A method conforming the polarization of a signal passing through an input waveguide configured for a first polarization signal to a desired polarization to which an output wave guide is configured, comprising the steps of:

(a) passing a signal from an input wave guide to an output wave guide through a polarization plate;

(b) modifying the polarization of a signal passing through the polarization plate

by a predetermined angle in either a clockwise or counter-clockwise direction to thereby provide a rotated polarization signal; and

(c) modifying the polarization of the rotated polarization signal passing through the polarization plate by the same predetermined angle in the direction required to achieve the desired polarization of the signal in the output wave guide.

84(New). The method as claimed in Claim 83, wherein the desired polarization of the signal is the same in the input and output wave guides and wherein the direction of rotation in step (c) is opposite to the direction of rotation in step (b).

85(New). The method as claimed in Claim 83, wherein the desired polarization of the signal in the output wave guide is orthogonal to the polarization on the signal in the input wave guide; and

wherein the direction of rotation in step (c) is the same as the direction of rotation in step (b).

86(New). The method as claimed in Claim 83, wherein the desired polarization of the signal in the output wave guide is orthogonal to the polarization on the signal in the input wave guide; and

wherein the predetermined angle is 45 degrees.

87(New). In a communications system having a first wave guide feeding an antenna where the waveguide is physically dimensioned for a signal having a selected one of two predetermined orthogonal polarizations and where the antenna is physically

dimensioned for a signal having a selected one of the same two orthogonal polarizations, a method of insuring that the polarization of the signal at the antenna is appropriate for the physical configuration of the antenna comprising the step of passing the signal through a polarization plate which effects two successive forty five degree rotations of the polarization of the signal.

88(New). A method of connecting a waveguide having one of two polarizations to an antenna having one of the same two polarizations comprising the steps of:

(a) rotating the polarization of the signal passing out of the waveguide in either a clockwise or counterclockwise direction by an amount equal one half the difference between the two polarizations; and

(b) rotating the polarization of the signal entering the antenna by an amount equal to one half the difference between the two polarizations.

89(New). A polarization plate for a signal having a wave length λ and one of two orthogonal polarizations comprising a waveguide having a length of approximately $1/4\lambda$, the physical configuration of said waveguide being associated with a polarization midway between said two orthogonal polarizations.

90(New). A waveguide system for a signal having a predetermined wavelength comprising:

a first waveguide physically configured for a signal having one of two orthogonal polarizations;

a second waveguide physically configured for a signal having one of the same two orthogonal polarizations; and

a polarization plate intermediate said first and second waveguides, said polarization plate having a thickness of approximately one quarter of said wavelength and a slot intermediate said two orthogonal polarizations.

wherein the slotted portion of the polarization plate is offset with respect to the first and second passage.--

REMARKS

The presence of allowable subject matter has been acknowledged. All of the foregoing amendments to the specification and drawings were made in the parent application. No new matter has been added (e.g. the length of the polarization plate was disclosed in original Claim 27. This Preliminary Amendment is filed to continue the prosecution of the application.

The examiner appears to have substantively misread the cited patents and all of the present claims are believable to be allowable over the cited art. The allowance of the application is accordingly solicited.

In one aspect, this application is directed to the problem of attaching an antenna physically configured for a signal having one polarization to a wave guide which may alternatively have the same or an orthogonal polarization. If, in the prior art, the polarization of the waveguide and the antenna were the same, there would be no problem

and no coupler would be required. If, in the prior art, the polarization of the waveguide and the antenna were orthogonal, a coupling was required to effect the polarization rotation. To insure operable coupling, knowledge of the polarization of both the antenna and the wave guide was required, so that one could know whether or not a coupler was required and,if so, what kind of coupler would be required, i.e., horizontal to vertical or vertical to horizontal. In one aspect, the present invention eliminates the need to know the polarization of either the antenna or the waveguide in operably connecting an antenna to a waveguide.

By using a polarization plate with an angle at 45°, i.e., midway between horizontal and vertical orientated polarizations as shown e.g., in Figure 4, the signal passing through the plate effects one 45° rotation as it enters the plate (without regard to the polarization of the wave guide) and effects a second 45° as it exits the plate and enters the antenna (again without regard to the polarization of the antenna). Saying it another way, the direction of the first rotation is automatically determined by the orientation in fact of the waveguide and the direction of the second rotation is automatically determined by the orientation in fact of the antenna.

By way of illustration, assume a vertical polarization (0°/180°) in the waveguide, a horizontal polarization (90°/270°) in the antenna, and a 45° slot in the plate. Note that the operation is a mirror image if the slot in the plate is orientated at 135° rather than 45°, so that the plate cannot be wrongly installed, front or back facing forward and upright or

upside down. The polarization of the wave entering the plate is rotated 45° in the direction as dictated by the relative orientation of the wave guide and slot (in this example clockwise), and the polarization of the wave entering the antenna is also rotated 45° as dictated by the relative orientation of the slot and the antenna (in this example clockwise). Two 45° rotations in the **same** direction effect the 90° rotation to effect coupling of an **orthogonally disposed** antenna and waveguide.

Where the polarization of the wave guide and antenna are the same (either horizontal or vertical), the first 45° rotation may be in either direction and the second 45° rotation will be in the **opposite** direction to effect the desired 0° rotation.

Thus, an antenna of one polarization may be replaced with an antenna of a different polarization without regard to the polarization of the wave guide. As indicated above, the polarization plate may be installed with the first rotation in either direction and that the orientation of the plate need not be changed to install an antenna of either polarization.

The novelty disclosed in the present application has been expressed in several different ways in the claims.

The patent to Nuding, et al ("Nuding") relates to a wave guide junction for connecting together two wave guides whose major transverse axes are inclined to one another. Nuding discloses two waveguides 1 and 2 each having a flange portion 7 and 8, respectively, which connect to one another at a single plane 4. (See column 2, lines 7-15)

The flange portions 7 and 8 each block a portion of the opening in the other (See Fig. 1 and 2b) to thereby create a discontinuity which requires screws 5 and 6 located in the wave guide to compensate for the discontinuity.

The undersigned has been unable to locate in Nuding the "two, equal-amount increments (0 and 4 degree)" referenced by the examiner, and understands that there is a single change in the shape of the wave guide, i.e., at the connecting plane 4 where the facing surfaces of the flanges 7 and 8 abut. Because of the thickness of applicant's plate (• /4 in a preferred embodiment), there are two changes in the shape of the wave guide, i.e. wave guide to plate and plate to antenna, which manipulate the polarization of the signal.

Nuding discloses a system having two components, i.e. waveguides 1 and 2 that are connected at their flange portions 7 and 8, whereas this application discloses a system having three components, i.e. two waveguides and an additional member not disclosed by Nuding.

The patent to Seavey does not remedy the deficiencies of Nuding. The surface 12 shown in Figure 4 is not a polarization plate as asserted, but the surface at the end of the rear launcher section. More specifically, Seavey teaches a horn for radiating circularly polarized energy where the end of the horn is square in cross-section with the plane of polarization so that the polarization of the wave exiting the device is along the diagonal of the square (see Seavey Abstract). The device disclosed in Seavey essentially comprises

of two pieces, the flared horn 14 and the rear launcher 11 which are coupled to one another. While the Examiner asserts that Seavey "shows a polarization plate 12 with an offset slot oriented 45 degrees and similar in geometry to the waveguide coupling and couples to an antenna to provide the desired polarization change", Sealey discloses that the rear launcher 11 is one solid piece and that reference 12 merely is used to refer to the input end of the rear launcher 11.

Since Seavey is directed to elliptical and circular polarization systems, there is no teaching with respect to the substitution of the horn of Seavey for the mating flanges of Nuding. Based on the Examiner's analysis, one skilled in the art would attempt to take the rear launcher 11 and place this between the two waveguides disclosed in Nuding. One skilled in the art would not attempt to combine the two references as the Examiner has in attempting to render the claims obvious. In the absence of some factual foundation, the combination is inappropriate and the rejection must be withdrawn.

Even if the teachings of the cited patents are combined as the Examiner has attempted, the combination would not function in the same manner as the device in the claims. It is clear that the Examiner is improperly attempting the hindsight reconstruction of the claims using teachings found only in the present invention.

The allowance of the independent claims is solicited and the claims that ultimately depend from the independent claims should be allowed without recourse to the additional patentable limitations respectively recited therein.

A further and favorable action and allowance of the application is solicited.

In the event that the application is not found to be in condition for allowance, applicant solicits a telephone call to arrange a personal interview.

Respectfully submitted,

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